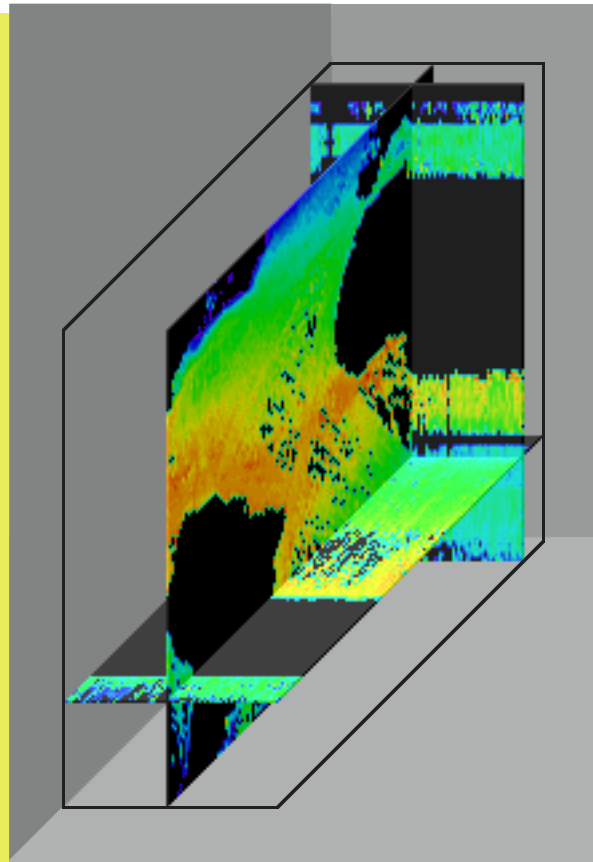# The COADS Dataset and New Statistical Techniques for Examining Climate Change in the Ocean Over Large Time and Space Scales.

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ORSTOM
**France**

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Stock Assessment Workshop, August 1994

A Contribution to the CEOS Project

The climatic variability in upwelling areas and the COADS dataset (1)

- COADS dataset : 100 millions surface weather observations distributed over the world oceans since 1854.

- This dataset allows one build time series of environmental parameters and to run comparative studies between areas.

- For CEOS program, the entire COADS dataset was tranfered to 6 CD-ROM and a program to access and summarize the data has been developped.
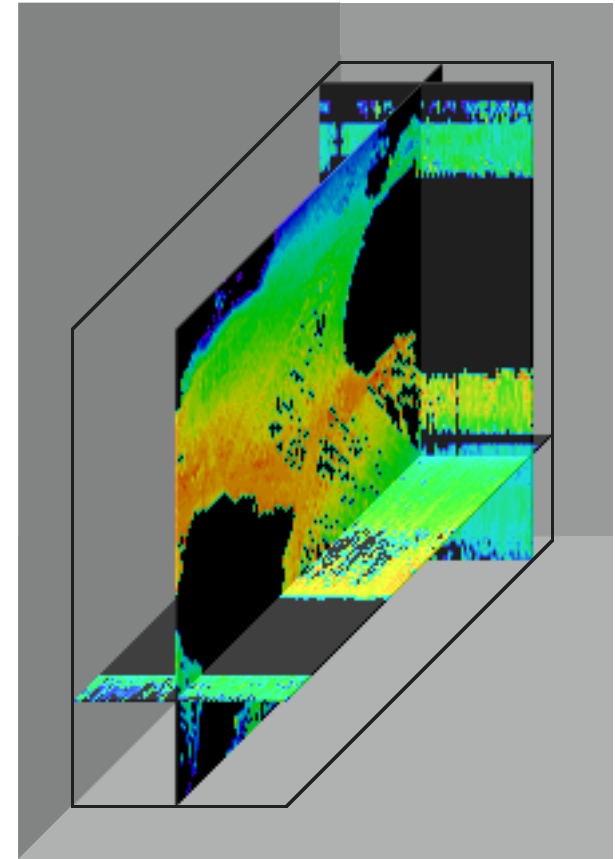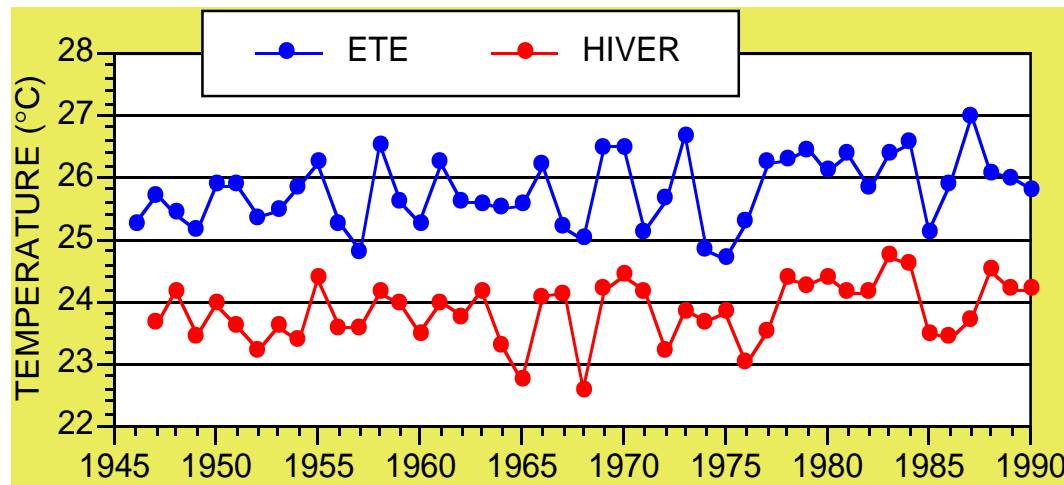
The CMR5 Format

- Date, time, position;

- Sea surface temperature;

- Air temperature and dew point;

- Wind speed and direction;

- Atmospheric pressure;

- For each observation, the parameters allow you to identify the origin, the measurement device etc. .; a statistical measure of the quality of the observation is also available.

CODE PROGRAM

- **Access to the original observation allows:**
  - **taking into account the changes through time in the instruments and procedures used to measure the data;**
  - **calculation of new parameters (eg : a wind mixing index, pseudo-stress etc.);**
  - **adapt the spatial grid to the density of the data, to the configuration of the coastline, or to the temporal changes in the shipping lanes.**

MERGING DATA FROM DIFFERENT ORIGINS
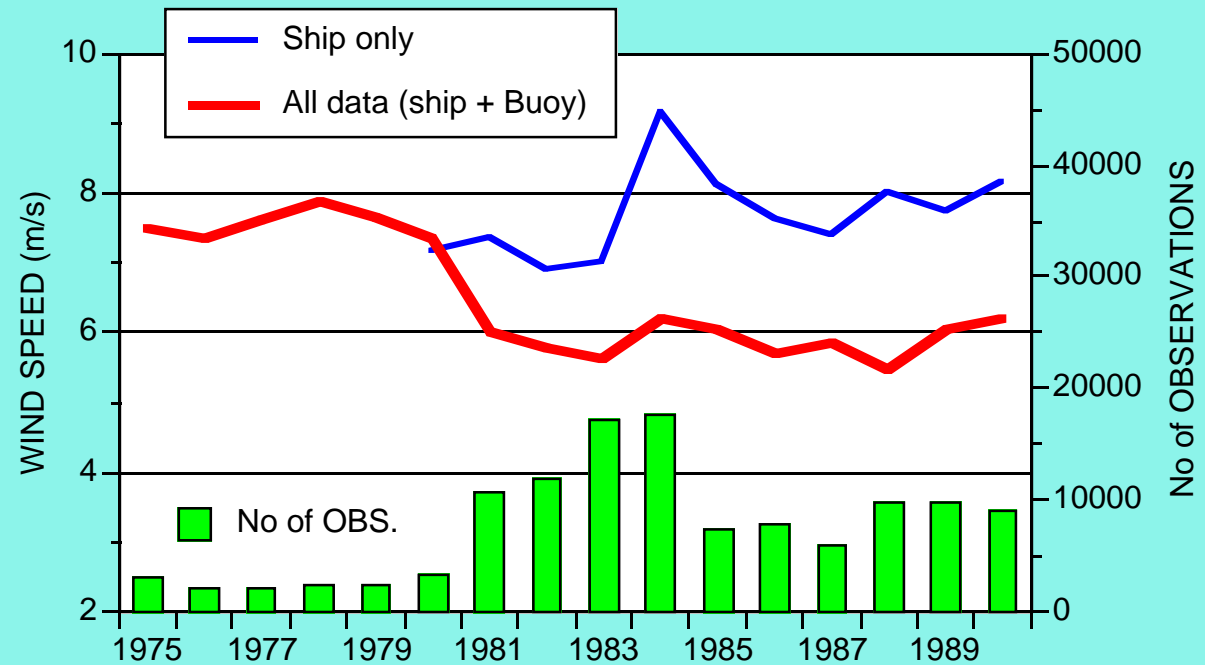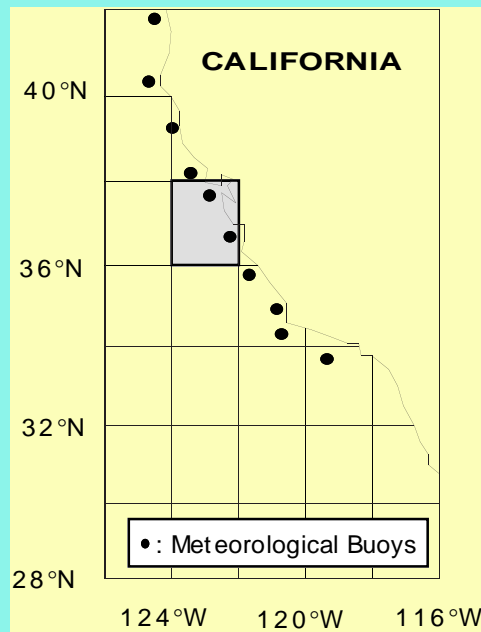
Starting in 1981, 6 hourly data coming from meteorological buoys were incorporated into the COADS data. Because of the coastal location of the buoys, the buoy's wind is lower than the ship's wind measured offshore.

When the COADS 2°x2° monthly file was computed, no discrimination was made between the data from the buoys and from the ships. The result is a pronounced decrease of the wind speed in 1981 off the California coast in the 2x2° monthly means product (red line).

When the buoy data are excluded from the calculation of the mean, the apparent decrease of the wind in 1981 disappeared (blue line).

Changes in the measurement procedure
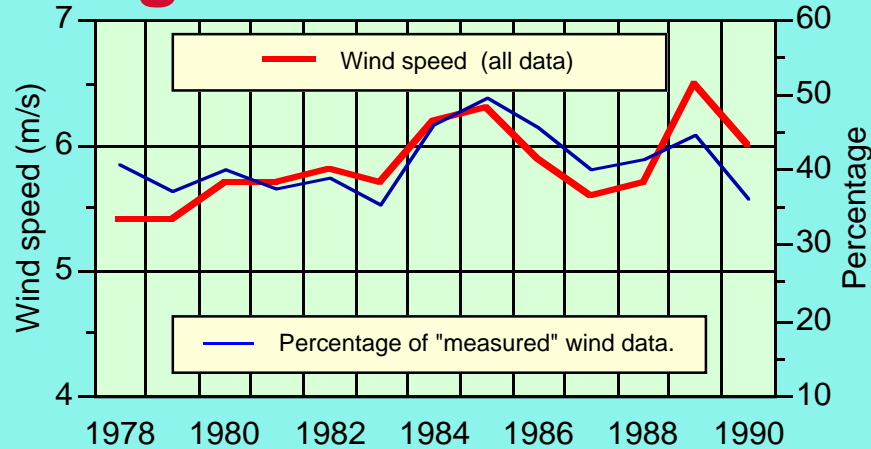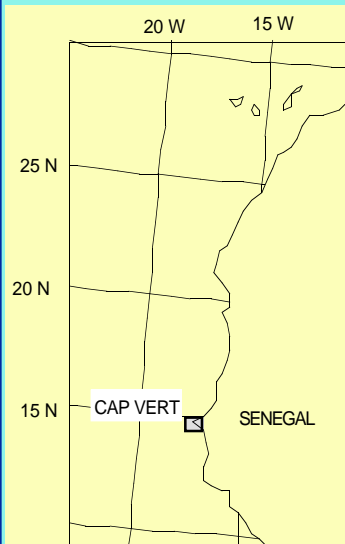
Mean annual wind speed off the Cap-Vert peninsula (Senegal) and percentage of "measured" wind data. (Coads data).

The magnitude of wind estimated using the Beaufort scale is slightly lower than the value given by an anemometer. The number of "measured" wind data varies from one year to another. The interannual fluctuations of wind speed appears to be related to the percentage of data collected using an anemometer.

Changes in the density of the data
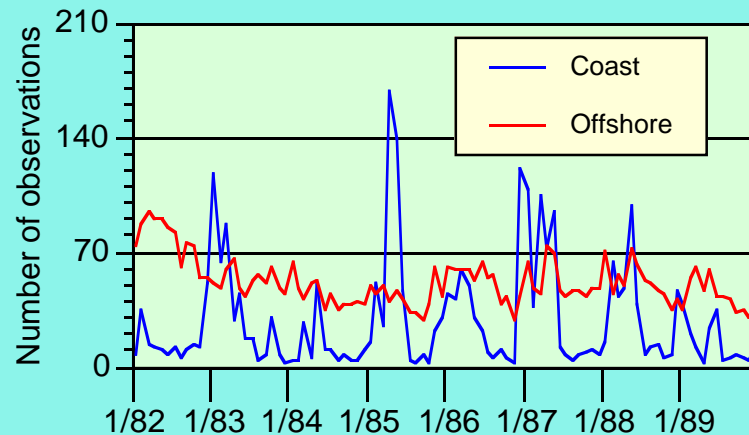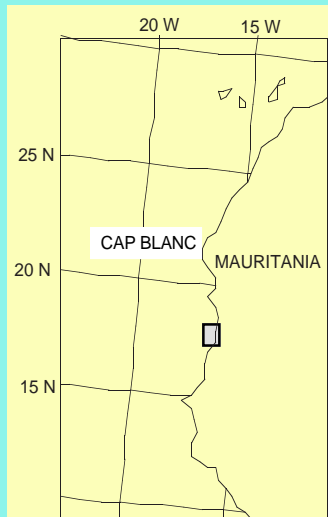
Monthly number of surface meteorological observations in the COADS data set in an area located off The coast of Mauritania.
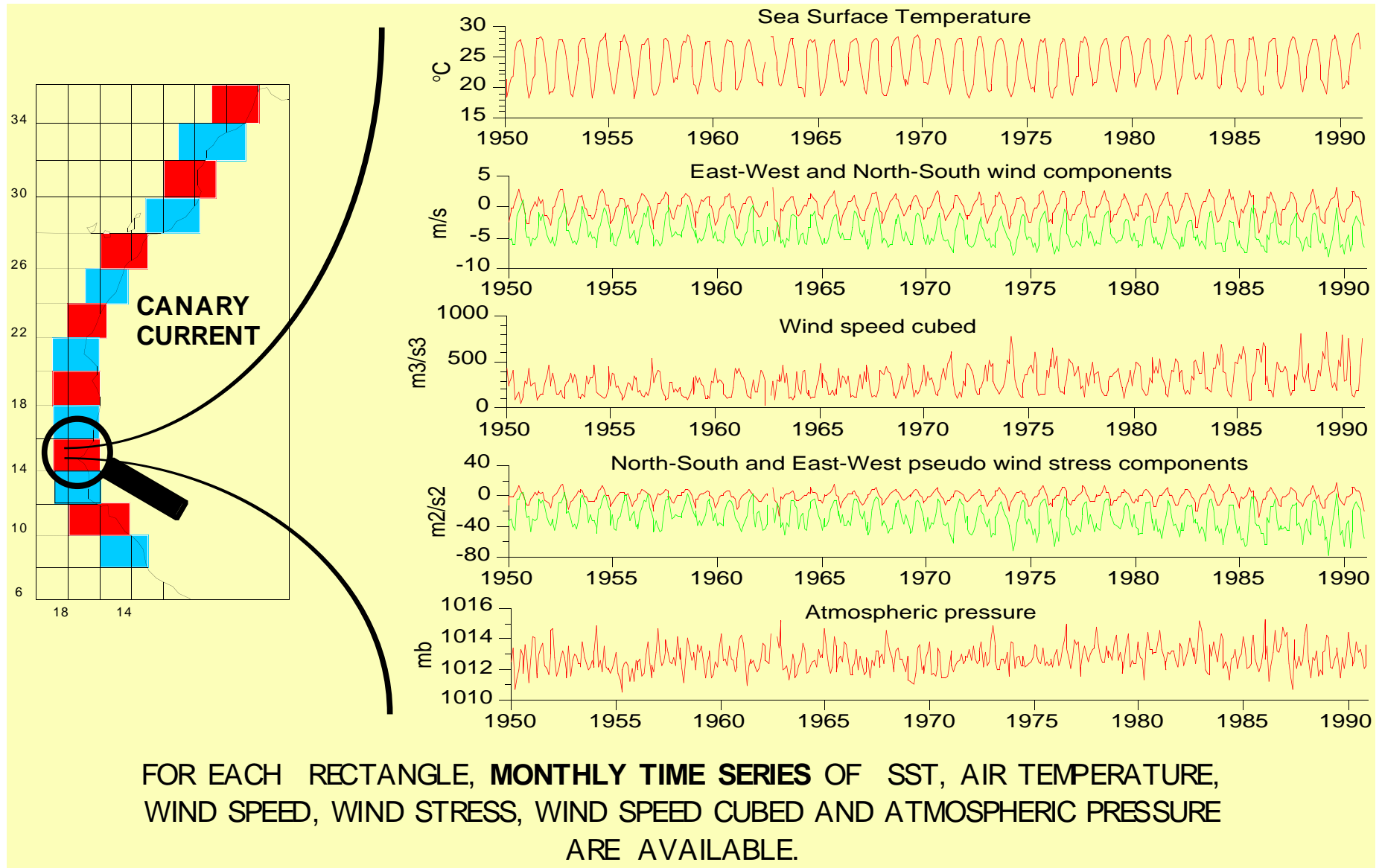
Off the coast of Mauritania the seasonal activity of the fishing fleet follows the seasonal extension of the upwelling. The number of meteorological observations collected along the coast shows a pronounced seasonal cycle. Further offshore, along the commercial ship route, the number of observations remains steady.

The climatic variability in upwelling areas and the COADS dataset (2)
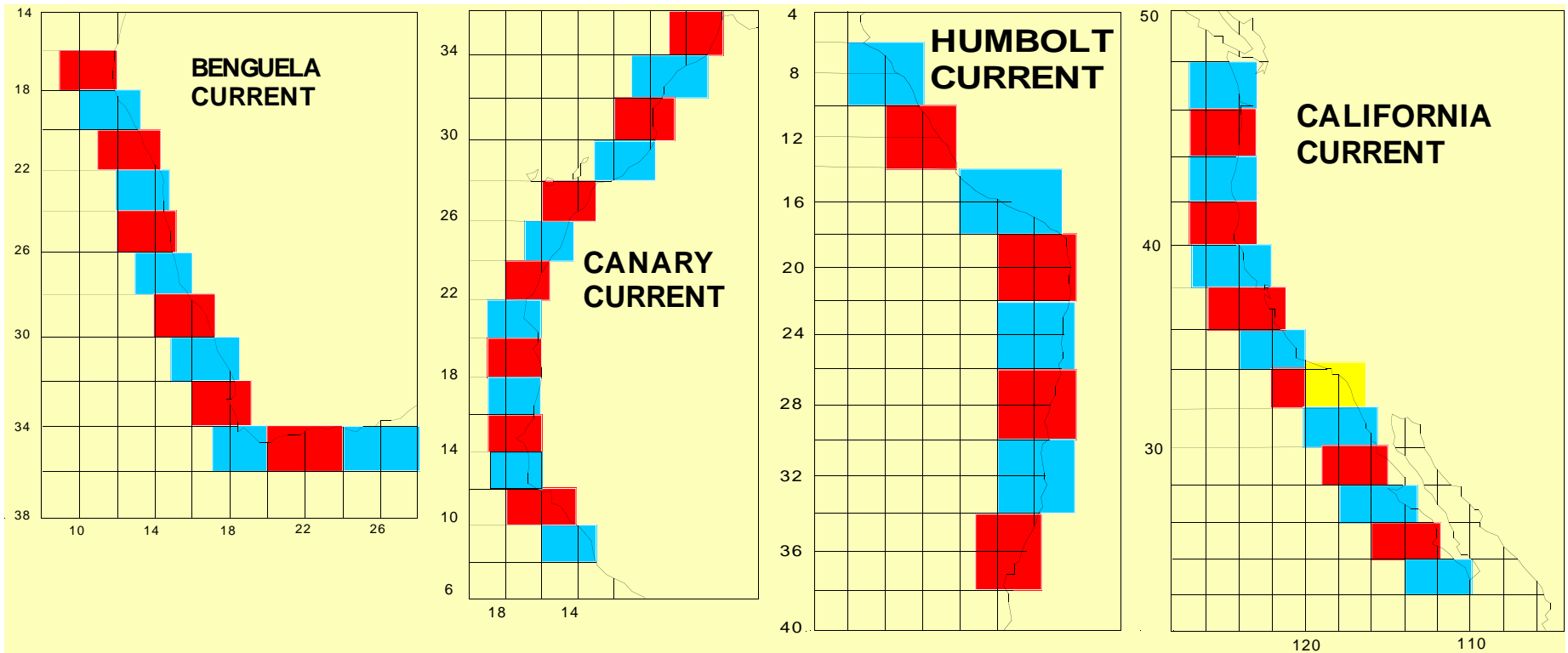
FOR THE FOUR MAIN UPWELLING AREAS, THE COADS DATA WERE EXTRACTED IN ORDER TO BUILD **MONTHLY TIME SERIES** OF ENVIRONMENTAL PARAMETERS. THE SPATIAL GRID IS DESIGNED TO TAKE INTO ACCOUNT THE DATA DENSITY (HIGH ALONG THE TRADE ROUTES) AND ALSO OCEANOGRAPHICAL AND ECOLOGICAL FEATURES. THE LATITUDINAL EXTEND IS 2° EXCEPT FOR THE HUMBOLT ECOSYSTEM WHERE IT IS 4° DUE TO THE LACK OF DATA. THE OFFSHORE EXTEND VARIES BETWEEN 2 ° AND 4°.

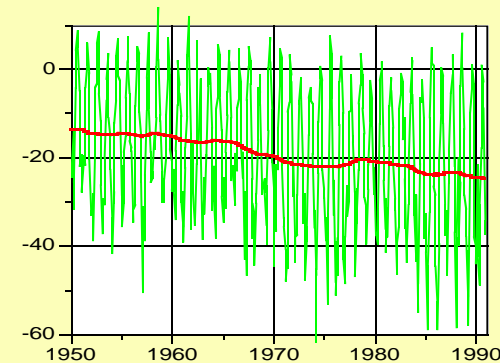# The climatic variability in upwelling areas and the COADS dataset (3)

CANARY CURRENT

Sea Surface Temperature

East-West and North-South wind components

Wind speed cubed

North-South and East-West pseudo wind stress components

Atmospheric pressure

FOR EACH RECTANGLE, **MONTHLY TIME SERIES** OF SST, AIR TEMPERATURE, WIND SPEED, WIND STRESS, WIND SPEED CUBED AND ATMOSPHERIC PRESSURE ARE AVAILABLE.

What is change ?

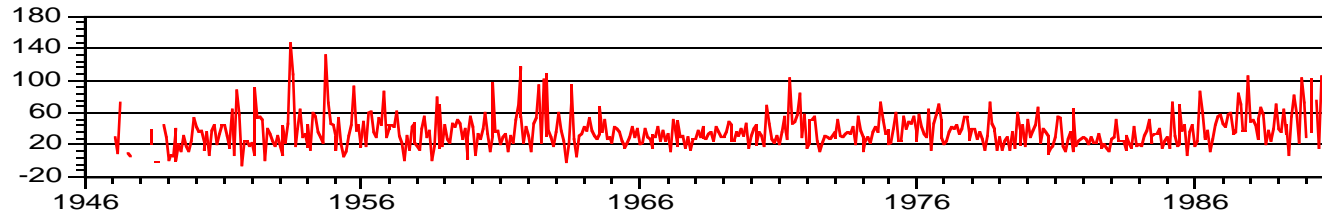- **Change of the mean level : trend**

- **Change in the seasonal cycle (amplitude and phase modulation)**
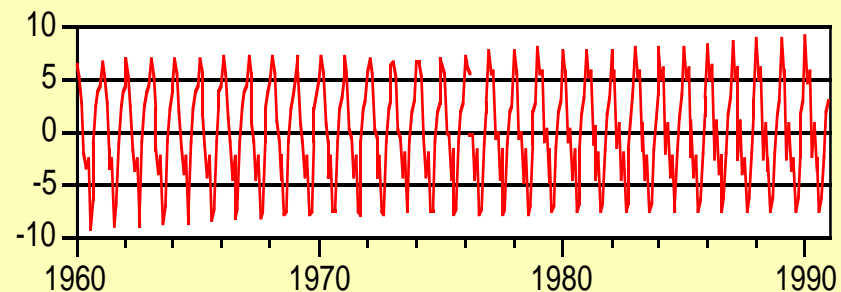
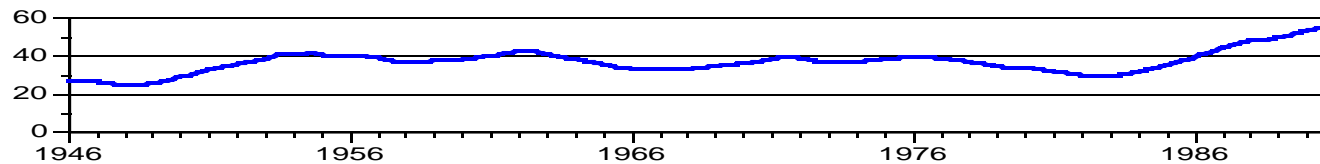- **Change in the variance structure through time**
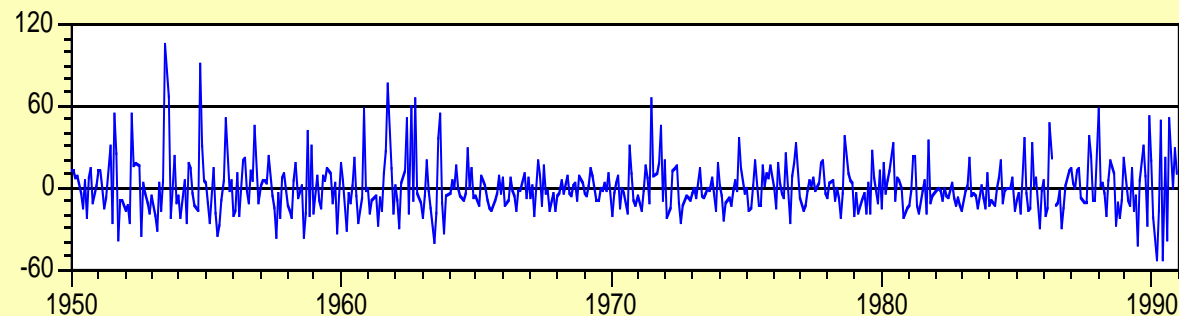
METHODOLOGY

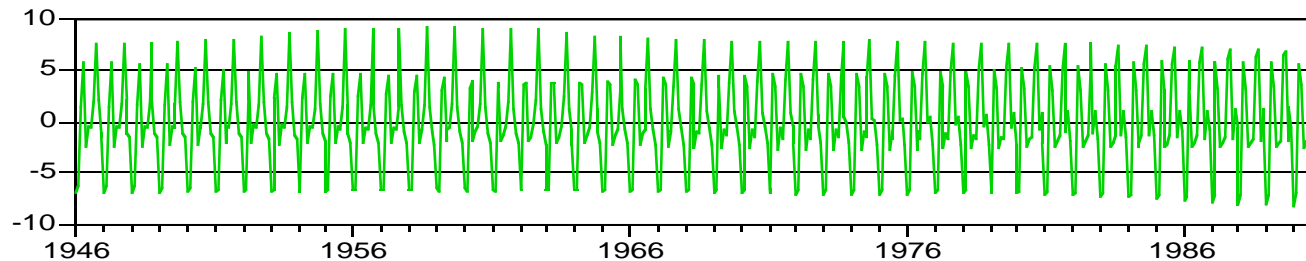

DECOMPOSITION OF THE OBSERVED TIME SERIES
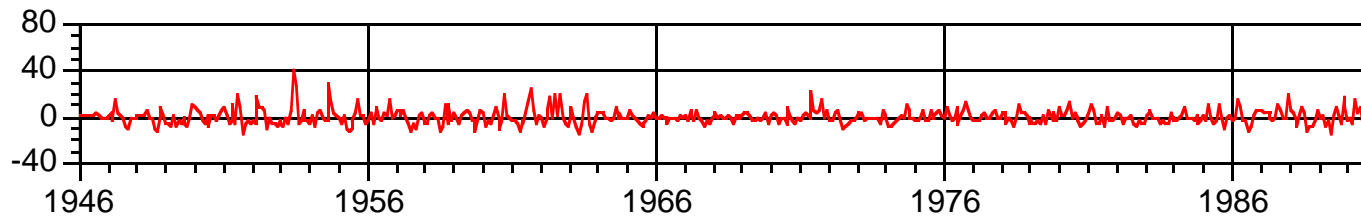
=

NON PARAMETRIC TREND

+

NON STATIONARY SEASONAL CYCLE

+

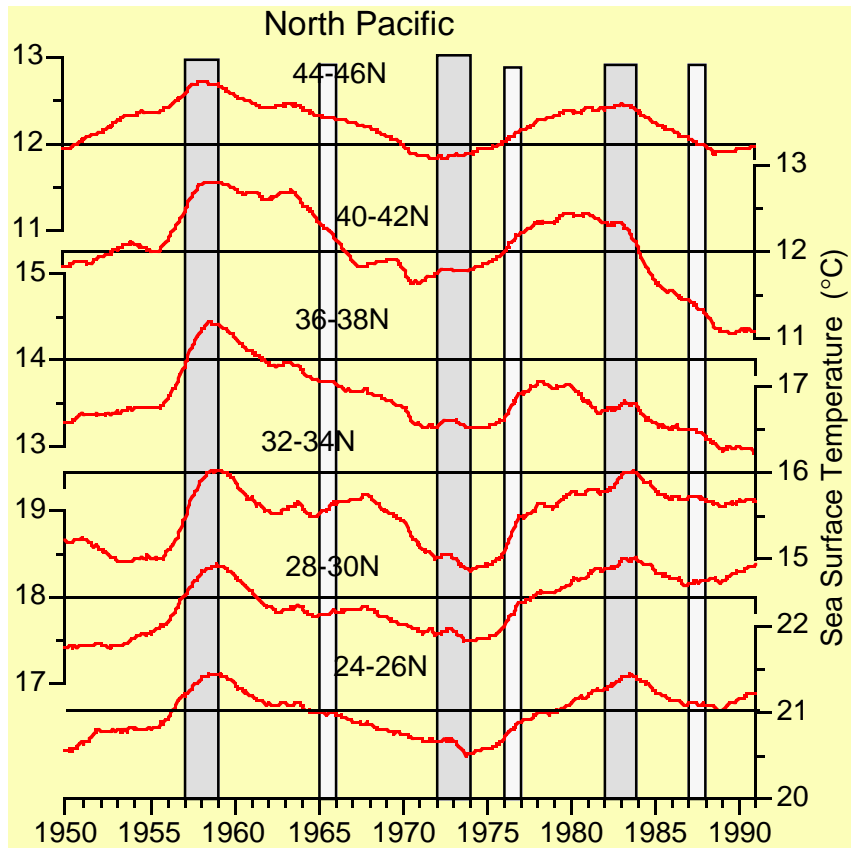## AUTOREGRESSIVE COMPONENT

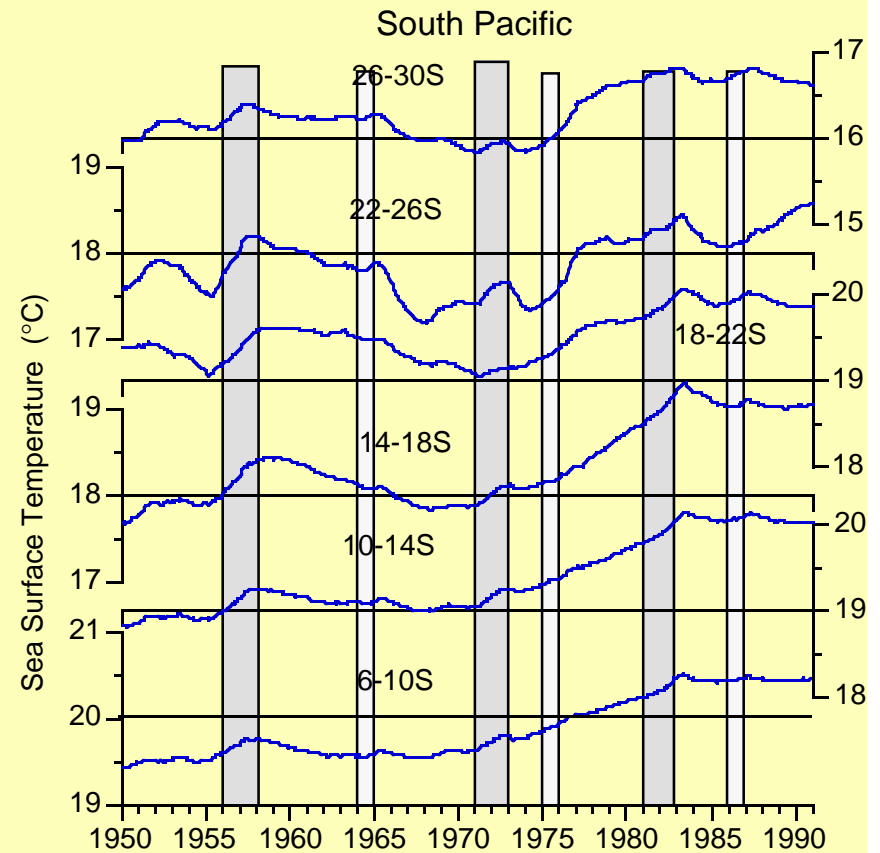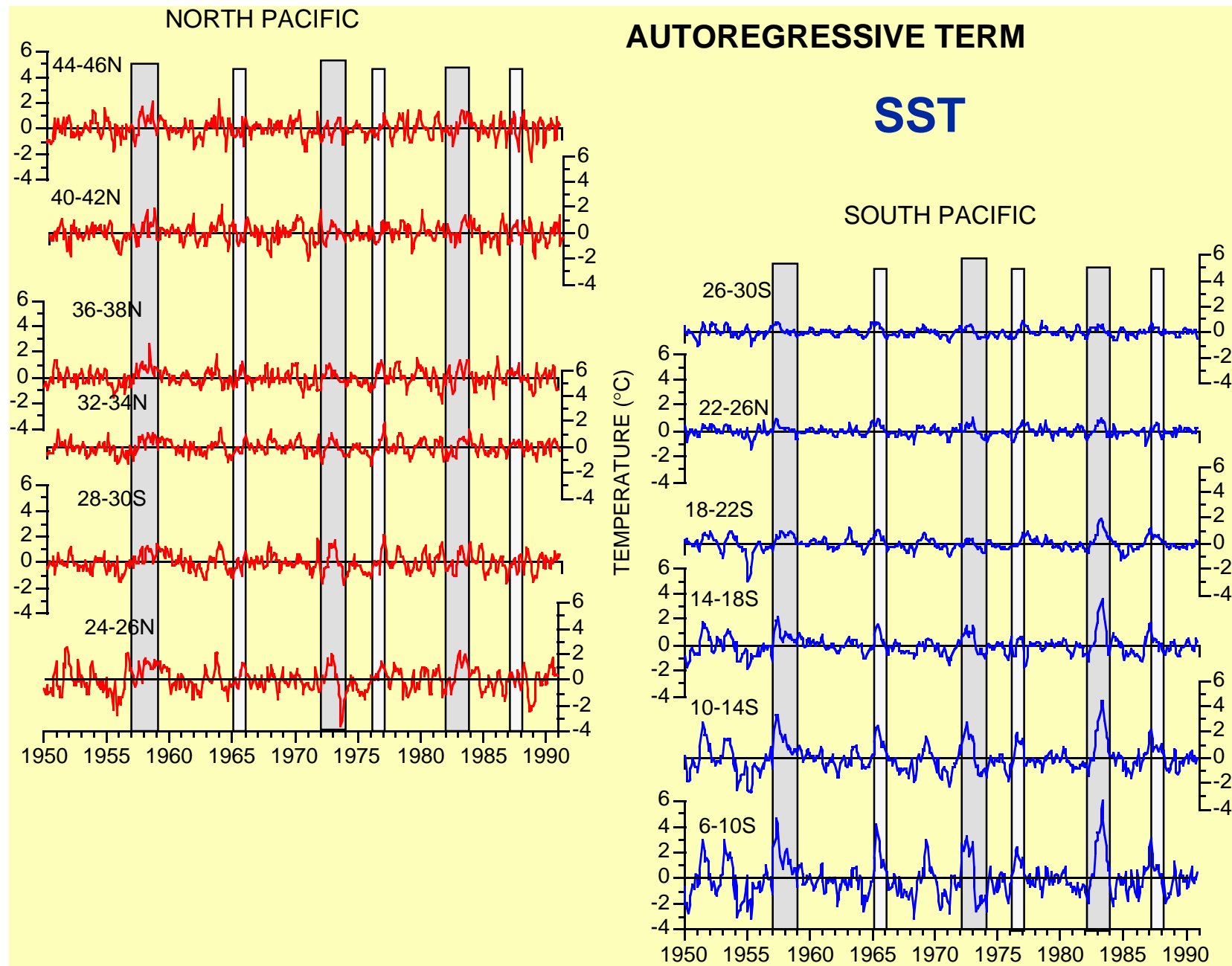
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RESIDUAL COMPONENT

LONG TERM TREND

SST

North Pacific

South Pacific

NORTH PACIFIC

AUTOREGRESSIVE TERM

SST

SOUTH PACIFIC

44-46N
40-42N
36-38N
32-34N
28-30S
24-26N

26-30S
22-26N
18-22S
14-18S
10-14S
6-10S

TEMPERATURE (°C)

NORTH PACIFIC PSEUDO STRESS